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Enclosed herewith is a Petition for Revival of an Application for Patent Abandoned Unintentionally under 37 CFR 1.137(b). This petition has been deemed necessary since it has been determined that the original USPTO Form PTO/SB/36 for rescinding the non-publication request, which was used for the present application, was found to be inadequate for providing the required notice of foreign filing, and would result in abandonment of the case. Notice is hereby provided that the present application was filed on March 15, 2001 in another country, or under a multilateral international agreement, that may require publication of applications eighteen months after filing.

REMARKS

Claims 58-61 and 63-73 remain in the application.

Claim 72 was indicated as rejected in the Summary Sheet, but it is not included in any of the specific rejections. Accordingly, the Reconsideration Request must be entered, and the Final Rejection must be withdrawn in order for the Examiner to clarify and to provide the Applicant the opportunity to respond in with respect to Claim 72.

35 USC 103 rejections

The Examiner has rejected claims 58-59 and claims 63, 65, 66, 67, 68, 70, and 73 under 35 USC 103(a) as being unpatentable over Uzoh in view of Murphy. Applicant respectfully traverses these rejections and requests reconsideration.

The Examiner has failed to properly consider the claimed inventive steps delimited in claims 58 and 59, which recite the use of a two-step polishing process

where the organic additive is included in the CMP slurry only at the very end of the polishing sequence. Specifically, claim 58 states "incorporating into said polishing slurry for a final portion of said total polishing period of time less than or equal to 10% of said total polishing period of time, an organic additive... said organic additive not being included in said polishing slurry prior to said final portion of said total polishing period of time". Similarly, claim 63 recites a two-step process where the slurry flow is decreased after a first polishing period, and the organic polishing additive is flowed during a second polishing period. This two-step polishing sequence has been developed as a method to minimize clogging of filters in the polisher (as stated in the specification, page 31, line 25), and to prevent copper staining and precipitates onto the wafer. There is no recognition by the Uzoh reference of any staining, precipitation, or clogging problems associated with the use of an organic additive during the entire polishing process, and Uzoh's process includes the Alkanol surfactant during the entire polishing period. Thus not only doesn't Uzoh recognize the problem and hence the source of the problem, but Uzoh expressly teaches away from the two-step polishing process claimed in the present invention by using an organic additive throughout the process.

The Examiner asserts that Murphy's teaching of column 6, lines 12-16, that "Time at temperature and mixing of the liquids can be delayed until the liquid is within centimeters of actual dispense onto the polishing pad" reads on the Applicant's claim of "additive not being included in said polishing slurry prior to said final portion of said total polishing period of time". Applicant strongly traverses this assertion. Murphy's invention is purely directed at the mixing of the slurry ingredients as soon as possible before the dispensing of the slurry onto the

wafer. In the citation by the Examiner, Applicant notes that Murphy specifies the time delay of mixing the liquids in terms of the time before the slurry is dispensed onto the polishing pad. This does not disclose or suggest a polishing process divided into two periods of time where the slurry is changed in the final period. Murphy in fact never mentions different slurries in different polishing periods on the wafer.

Applicant strongly asserts that the "time" referred to in the Murphy reference, i.e. "time at temperature and mixing of the liquids can be delayed until the liquid is within centimeters of actual dispense onto the polishing pad" is clearly directed toward the timing of the travel of the slurry through the dispensing line and onto the sample. Murphy's time of mixing is specified according to the location of the slurry relative to the sample ("within centimeters") rather than to the amount of time elapsed in the polishing process. There is no indication in Murphy that this location-determined time of mixing is not steady state, in other words there is no indication in Murphy that the point-of-use mixing is not constant during the entire duration of the polishing process. There is no indication in Murphy of a two-step process according to the total polishing time. Murphy, accordingly, does not teach, imply, or suggest a two-step process as described and claimed in the present invention, where the organic additive in the polishing slurry is included only during the final portion of the total polishing period of time.

In view of Uzoh's teaching away from the two-step polishing process claimed in the present invention, and of the total absence of any teaching or implication in Murphy regarding a two step process wherein the organic additive is included in the slurry only during a final portion of the polishing period of the wafer, Applicant strongly asserts that the Examiner has failed to make a prima

facie case that the present invention is taught or implied by Uzoh, Murphy, or a combination of the two. Applicant further asserts that, since the two step process as broadly claimed in claims 58, 59, and 63 is neither taught nor implied by Uzoh and Murphy, the more narrowly defined process steps as claimed in claims 65, 66, 67, 68, 70, and 73 are also neither taught nor implied by Uzoh and Murphy.

Applicant therefore respectfully requests that the 35 USC 103 rejections of claims 58, 59, 63, 65, 66, 67, 68, 70, and 73 be withdrawn.

The Examiner has rejected claims 60-61, 64, 69, 71, and 73 under 35 USC 103 as being unpatentable over Uzoh in view of Murphy et al and further in view of Yu et al. Applicant respectfully traverses these rejections.

As described above, there is no recognition in the Uzoh reference of any staining, precipitation, or clogging problems associated with the use of an organic additive during the entire polishing process or of the cause of the problem, and Uzoh's process expressly requires the Alkanol surfactant during the entire polishing period. Thus Uzoh clearly teaches away from the two-step polishing process claimed in the present invention. Further, there is no teaching, implication, or suggestion in Murphy of including an organic additive in the polishing slurry, as claimed in the present invention, only during the final portion of the total polishing period of time. Accordingly, Applicant asserts that the present invention is neither taught nor implied by Uzoh, Murphy, or a combination of the two.

Applicant further asserts that the inclusion of Yu in no way provides any implication or teaching of the present invention, or in specific of the process details, including concentrations, as claimed in claims 60-61, 64, 69, 71, and 73 of the present invention. Yu does not describe, disclose, teach, or imply a two step

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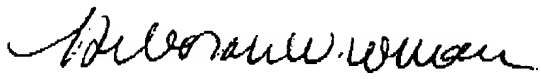
polishing process as in the present invention, wherein an organic additive is included for a final portion only of the total wafer polishing time. Yu discusses adjustability of process parameters, but adding this reference does not assist in making a prima facie case. The claimed elements of this process are not disclosed in any of the references, and even if it were suggested to combine these references, since the claimed elements are not disclosed, the Examiner has not presented a prima facie case.

Applicant therefore respectfully requests that the 35 USC 103 rejections of claims 60, 61, 64, 69, 71, and 73 be withdrawn.

Applicant has made a diligent attempt to address all of the Examiner's points. It is believed that the application is now in condition for allowance. An early Notice is requested. Alternatively, the Final Rejection must be withdrawn to clarify the matter with respect to claim 72.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

58. (twice amended) A Chemical-Mechanical Polishing (CMP) method for polishing Ta barrier layers in integrated circuit metallization structures including copper and silica, said method including flowing polishing slurry containing silica abrasive, DI water, and a copper passivation agent, onto a platen, inducing relative motion between said wafer and said platen and maintaining a force between said platen and said wafer, and removing said wafer from against said platen, said polishing occurring for a total polishing period of time, comprising,

incorporating into said polishing slurry for a final portion of said total polishing period of time less than or equal to 10% of said total polishing period of time, an organic additive selected from the group consisting of:

polyvinyl alcohol (PVA), PVA-poly(vinyl acetate) co-polymer, PVA-polyethylene co-polymer, sorbitol, glycerol, polyacrylamide (PAA), ethylene glycol, di(ethylene glycol), poly(ethylene glycol) (PEG), glycerol ethoxylate (GEO), dimethylsiloxane-ethylene oxide co-polymer (DMSiO-EO), polyethylene oxide surfactants, octylphenol polyethylene oxide, nonylphenol polyethylene oxide, polyoxyethylene lauryl ether, polyoxyethylene cetyl ether, perfluorinated analogs of polyethylene oxide surfactants, glycerol propoxylate (GPO), organic amines, N,N-diethylcyclohexylamine (DCA), and polyethyleneimine (PEI);

said organic additive not being included in said polishing slurry prior to said final portion of said total polishing period of time.

63. (twice amended) In a Chemical-Mechanical Polishing (CMP) method for polishing Ta barrier layers in integrated circuit metallization structures including

organic amines, N,N-diethylcyclohexylamine (DCA), and polyethyleneimine (PEI).

57. The method of claim 56, wherein said at least a portion of said total polishing period of time is the entire said total polishing period of time.

58. The method of claim 56, wherein said at least a portion of said total polishing period of time is substantially equal to or less than the last 10% of said total polishing period of time.

59. The method of claim 58, wherein said polishing slurry containing said organic additive is formed by Point-of-Use (POU) mixing of said organic additive with said polishing slurry containing said DI water, said silica abrasive, and said Cu passivation agent.

60. The CMP method of claim 59, wherein said organic additive comprises PEG-10000 and said Cu passivation agent comprises 1,2,4-triazole.

61. The CMP method of claim 60, wherein said polishing slurry containing said organic additive comprises:

1.54 wt % 1,2,4-triazole;

0.5 wt% PEG-10,000;

93.6 wt % silica suspension containing 13.6 wt% SiO_2;

4.33 wt% DI water.

62. A polishing additive solution comprising,

63. (twice amended) In a Chemical-Mechanical Polishing (CMP) method for polishing Ta barrier layers in integrated circuit metallization structures including copper and silica, said method including flowing polishing slurry containing silica abrasive, DI water, and a copper passivation agent onto a platen, inducing relative motion between said wafer and said platen while maintaining a force between said platen and said wafer, and removing said wafer from against said platen, said polishing occurring for a first polishing period of time, the improvement comprising:

decreasing said flow of said polishing slurry prior to said step of removing said wafer from against said platen; and

following said step of decreasing said flow of said polishing slurry and prior to said step of removing said wafer from against said platen, flowing a polishing additive solution onto said platen for a second period of time while inducing relative motion between said wafer and said platen and maintaining a force between said platen and said wafer;

said polishing additive solution comprising;

DI water;

a copper passivation agent selected from the group consisting of, 1,2,4-triazole, benzotriazole (BTA), imidazole, 5-methyl benzimidazole, polyaniline, indazole, and purine; and

an organic additive selected from the group consisting of, polyvinyl alcohol (PVA), PVA-poly(vinyl acetate) co-polymer, PVA-polyethylene co-polymer, sorbitol, glycerol, polyacrylamide (PAA), ethylene glycol, di(ethylene glycol), poly(ethylene glycol) (PEG), glycerol ethoxylate (GEO), dimethylsiloxane-ethylene oxide co-polymer (DMSiO-EO), polyethylene oxide surfactants, octylphenol polyethylene oxide, nonylphenol polyethylene oxide, polyoxyethylene lauryl

ether, polyoxyethylene cetyl ether, perfluorinated analogs of polyethylene oxide surfactants, glycerol propoxylate (GPO), organic amines, N,N-diethylcyclohexylamine (DCA), and polyethyleneimine (PEI);

said polishing slurry not including said organic additive prior to said step of flowing said polishing additive solution.

decreasing said flow of said polishing slurry prior to said step of removing said wafer from against said platen; and

flowing the polishing additive solution of claim 62 onto said platen for a second period of time while inducing relative motion between said wafer and said platen and maintaining a force between said platen and said wafer..

64. The method of claim 63 wherein the step of decreasing said flow of said slurry decreases said flow to zero.

65. The CMP method of claim 63, wherein said organic additive comprises PEG-10,000 and said copper passivation agent comprises 1,2,4-triazole.

66. The CMP method of claim 63, wherein said steps of decreasing said flow of said polishing slurry and flowing of said polishing additive solution are performed just prior to wafer de-chuck operation.

67. The CMP method of claim 66, wherein the step of decreasing said flow of said slurry decreases said flow to zero.

68. The CMP method of claim 67, wherein said organic additive comprises PEG-10,000 and said copper passivation agent comprises 1,2,4-triazole.

69. The CMP method of claim 68, wherein said polishing additive solution comprises:

3.0 wt % 1,2,4-triazole;

0.5 wt % PEG- 10,000. and

DI water.

70. The CMP method of claim 63, wherein said steps of decreasing said flow of said polishing slurry and flowing of said polishing additive solution are performed just prior to post-Ta CMP buff operation.

71. The CMP method of claim 70, wherein the step of decreasing said flow of said slurry decreases said flow to zero.

72. The CMP method of claim 71, wherein said organic additive comprises PEG-10,000 and said copper passivation agent comprises 1,2,4-triazole.

73. The CMP method of claim 72, wherein said polishing additive solution comprises:

2.0 - 3.0 wt % 1,2,4-triazole;

0.1 – 2.0 wt % PEG-10,000, and

DI water;

and wherein said post-CMP buff step utilizes 0.5 – 2.0 psi down force for 5 – 30 seconds. lacks antecedent